

# Energy Recovery Linac (ERL) Source Properties

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## ABSTRACT:

Energy Recovery Linacs are being explored as next generation synchrotron light sources. The fundamental x-ray beam properties from storage ring sources, such as the source size, brilliance, and pulse duration are limited by the dynamic equilibrium characteristic of the magnetic lattice that is the storage ring. Importantly, the characteristic equilibration time is long, involving thousands of orbits around the ring. Advances in laser-driven photoelectron sources allow the generation of electron bunches with superior properties for synchrotron radiation. ERLs preserve these properties by acceleration with a superconducting linac, followed by transport through a return loop hosting insertion devices, similar to that of a 3<sup>rd</sup> generation storage ring. The loop returns bunches to the linac 180° out of accelerating phase for deceleration through the linac and disposal. Thus, the electron beam energy is recycled back into the linac RF field for acceleration of new bunches and the equilibrium degradation of bunches never occurs. The superior properties of ERLs beams include extraordinary brilliance and small source size, with concomitant high transverse coherence, x-ray pulse durations down to ~100 femtoseconds, and flexibility of operation. The source properties will be discussed in terms of coherent applications.